direct translation of the claims of the PCT application as filed in French

CLAIMS

1. A reaction cartridge comprising a plurality of reaction chambers (13) and at least one reservoir (11) and having the following characteristics:

   - each reaction chamber is connected to the reservoir via a channel (12) having a cross section included in a circle with a diameter of less than 3 mm;
   - the capacity of the reservoir is less than 10 ml;
   - the disposition of the reaction chambers and the channels with respect to the reservoir allows a fluid to be homogeneously distributed into the reaction chambers from the reservoir.

2. A cartridge according to claim 1, in which the diameter of the channels (12) is 0.2 mm or less.

3. A cartridge according to claim 1 or claim 2, in which the capacity of the reservoir (11) is in the range of 0.1 ml to 1 ml.

4. A cartridge according to claims 1 to 3, characterized in that it comprises 20 to 500 reaction chambers.

5. A cartridge according to claims 1 to 4, characterized in that the volume of the reaction chambers is in the range of 0.2 µl to 50 µl, preferably in the range of 1 µl to 10 µl.

6. A cartridge according to claims 1 to 5, in which the junction between the channels (12) and the reservoir (11) is formed at the periphery of the reservoir, and the base of said reservoir is inclined and/or convex, to ensure distribution of a fluid contained in the reservoir to the inlet to the channels.

7. A cartridge according to claims 1 to 6, characterized in that it has a geometry of revolution, in which the reservoir (11) is placed substantially at the centre of said cartridge, the reaction chambers (13) are distributed in a circle around said reservoir, and the channels (12) connecting said reservoir to said chambers are essentially radial.

8. A cartridge according to claim 7, in which the base of the reservoir (11) is conical.

9. A cartridge according to claim 7 or claim 8, in which the reaction chambers (13) are placed at the periphery of said cartridge.

10. A cartridge according to claims 7 to 9, with a diameter in the range of 1 to 10 cm.

11. A cartridge according to claims 1 to 6, characterized in that it has a translational geometry, in which the reservoir (11) is placed on one side of said cartridge, the reaction cartridges (13) are aligned on the other side of the cartridge, and the channels (12) connecting the reservoir to said chambers are essentially parallel to each other.

12. A cartridge according to claim 11, in which the base of the reservoir (11) is an inclined plane.

13. A cartridge according to any one of claims 1 to 12, in which the reservoir (11) is divided into 2 to 8 sub-reservoirs (111 to 118), and each of the reaction chambers (13) is connected to just one of said sub-reservoirs via a channel (12).

14. A cartridge according to any one of claims 1 to 13, in which the depth of the reaction chambers is in the range of 0.5 to 1.5 mm.

15. A cartridge according to any one of claims 1 to 14, characterized in that it is produced from a plastics material, preferably polycarbonate.

16. A cartridge according to any one of claims 1 to 15, in which the thickness is in the range of 0.5 to 5 mm.

17. A cartridge according to any one of claims 1 to 16, in which the floor of the reaction chambers (13) is in the range of 0.05 to 0.5 mm thick, preferably about 0.25 mm thick.

18. A cartridge according to any one of claims 1 to 17, in which the reaction chambers (13) are closed by an upper transparent wall (17).

19. A cartridge according to any one of claims 1 to 18, in which the reaction chambers (13) are provided with vents (14).

20. A cartridge according to any one of claims 1 to 18, in which the reaction chambers (13) are closed.

21. A cartridge according to any one of claims 1 to 20, in which the reservoir (11) comprises an opening that can be adapted to means (4) for adjusting the pressure in said reservoir.

22. A cartridge according to any one of claims 1 to 21, in which each channel (12) is constituted by at least two portions with different diameters (121 and 122), the diameter of the second portion (122) being less than that of the first portion (121), so as to create a pressure drop in the channel (12).

23. A cartridge according to any one of claims 1 to 22, characterized in that each channel (12) is provided with an anti-reflux cavity (123) at its junction with the reservoir (11), said anti-reflux cavity being constituted by a substantially vertical channel portion with a diameter that is equal to or greater than that of the channel (12).

24. A cartridge according to any one of claims 1 to 23, in which at least a portion of the reaction chambers (13) comprises oligonucleotides.

25. A cartridge according to any one of claims 1 to 24, in which each reaction chamber (13) comprises two primers specific for a nucleic acid sequence to be amplified and, optionally, a labelled probe specific for said sequence.

26. A cartridge according to any one of claims 1 to 25, in which at least a portion of the reaction chambers (13) contains reagents that are deposited therein by depositing a liquid followed by drying, such that the arrival of a fluid in said reaction chambers takes said reagents up into solution again.

27. A device for carrying out enzymatic and/or molecular biological reactions requiring at least two different incubation temperatures, characterized in that it comprises:

- at least one cartridge (1) having a plurality of reaction chambers (13) and a reservoir (11), said reaction chambers being connected to the reservoir via channels (12);
- at least one heating plate (2) having at least two distinct zones that can be heated to at least two different temperatures;
- means (3) for relative displacement between said cartridge and said plate, allowing a cyclic variation of the temperature of the reaction chambers.

28. A device according to claim 27, in which the enzymatic reaction is thermodependent chain amplification of nucleic acid sequences, and in which the zones of the heating plate (2) can be heated to at least two different temperatures, corresponding to phases in the nucleic acid amplification cycles.

29. A device according to claim 28, characterized in that:

- primers specific for the target sequences to be amplified are pre-distributed in the reaction chambers (13),

- the reservoir (11) is intended to receive a fluid composed of a sample of nucleic acids to be analysed and the reagents required for a polymerase chain amplification reaction, with the exception of primers,
- the heating plate (2) has three distinct zones that can be heated to three different temperatures corresponding to the three polymerase chain reaction amplification cycles.

30. A device according to claim 28 or 29, for real-time thermodependent chain amplification of nucleic acid sequences, characterized in that it comprises optical means (5) for fluorescence excitation / measurement, disposed so as to excite and measure the fluorescence of the contents of the reaction chambers in each cycle.

31. A device according to any one of claims 27 to 30, in which the cartridge (1) is a cartridge according to any one of claims 1 to 26.

32. A device according to any one of claims 27 to 31, in which the distinct zones for heating the plate (2) are distributed into at least two or three disk portions.

33. A device according to any one of claims 27 to 32, in which said heating plate (2) is fixed and said cartridge (1) is moved by means of displacement means (3).

34. A device according to any one of claims 27 to 32, in which said cartridge (1) is fixed and said heating plate (2) is moved by means of displacement means (3).

35. A device according to any one of claims 27 to 34, in which said displacement means (3) cause rotation of said cartridge (1) and/or said heating plate (2).

36. A device according to any one of claims 27 to 35, in which the cartridge (1) is in direct contact with the heating plate (2).

37. A device according to any one of claims 27 to 36, in which the plate (2) is provided with a coating encouraging relative displacement between said cartridge (1) and said plate (2).

38. A device according to any one of claims 27 to 37, in which the heating plate (2) comprises two or three distinct thermoblocks (21, 22 and if necessary, 23) connected to means for programming their temperature.

39. A device according to any one of claims 27 to 38, in which the bottom of the cartridge (1) has a central projecting portion (181) comprising a notch (182), and the displacement means (3) include at least one driver (32) co-operating with said notch (182) to cause said cartridge (1) to move in a rotary motion.

40. A device according to any one of claims 27 to 39, comprising optical means (5) for fluorescence excitation / measurement disposed above or to the side of the cartridge.

41. A device according to any one of claims 27 to 40, further comprising means (4) for supplying fluid present in the reservoir (11) to the reaction chambers (13).

42. A device according to claim 41, in which said supply means (4) include a piston device (41), and the fluid is supplied to the reaction chambers by increasing the pressure.

43. A device according to claim 41, in which said supply means (4) include a pump (41), and the fluid is supplied to the reaction chambers by re-establishing the pressure after establishing an underpressure.

44. A device according to claim 43, in which the reaction chambers (13) of the cartridge (1) are closed.

45. A method for amplifying a nucleic acid using an instrument according to any one of claims 27 to 44, comprising the following steps:

- at least partially filling a reservoir (11) with a fluid containing a sample of nucleic acids to be analysed and the components required for carrying out an amplification reaction, with the exception of primers, and optionally, a fluorescent nucleic acid reporter;
- distributing said fluid to the reaction chambers of the cartridge (1), in which are located the primers and optional one or more labelled probes;
- employing means (3) for relative displacement between the cartridge and the heating plate to successively bring the contents of each reaction chamber to the two, three or more temperatures defined by the two, three or more zones of said heating plate, as many times as is desired.

46. An amplification method according to claim 45, in which the step for distributing fluid to the reaction chambers (13) is carried out by applying an underpressure inside the cartridge, then re-establishing the pressure.

47. A process for closed system filling of reaction chambers (13) in a cartridge (1) according to claim 21, comprising the following steps:

- at least partially filling the reservoir (11) with a fluid;
- connecting the cartridge (1) to means (4) for adjusting pressure;

- applying an underpressure inside the cartridge, then re-establishing the pressure.